



Positive mental health framework of transdiagnostic protective factors in elucidating the association between adverse childhood experiences and severe mental disorders

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Abstract

Objectives: Transdiagnostic risk factors—disrupted processes common to psychopathology—link adverse childhood experiences to severe mental disorders (i.e. major depressive disorder, bipolar disorder, and schizophrenia spectrum disorders); however, transdiagnostic protective factors are understudied. The present study investigated the association between a positive mental health framework of protective intra- and interpersonal resources and severe mental disorders in individuals with adverse childhood experiences. We hypothesized that (1) individuals with adverse childhood experiences will experience more severe mental disorders and poorer intra- and interpersonal resources than those without adverse childhood experiences; (2) intrapersonal (e.g. general coping) and interpersonal resources (e.g. emotional support) will interact to predict severe mental disorders.

Methods: A total of 1929 adults participated in this population-based study. Participants were assessed for adverse childhood experiences, severe mental disorders, and intra- and interpersonal resources (general coping, general affect, emotional support, interpersonal skills, spirituality, and personal growth and autonomy) via structured interviews and self-reports.

Results: As hypothesized, individuals with adverse childhood experiences (62.6%) experienced more severe mental disorders and poorer intra- and interpersonal resources than those without adverse childhood experiences. Among those with adverse childhood experiences, emotional support interacted with general coping and general affect to predict severe mental disorders; general coping and general affect were negatively associated with severe mental disorders at high (+1 SD) and low (−1 SD) emotional support, respectively.

Conclusions: The present study identified interactions between specific intrapersonal (i.e. general coping and general affect) and interpersonal resources (i.e. emotional support); knowing *among whom* and *when* to intervene are essential for optimal treatment of adverse childhood experiences and severe mental disorders.

Keywords

Adverse childhood experiences, severe mental disorders, positive mental health, intrapersonal resources, interpersonal resources

Introduction

Adverse childhood experiences include both stressful and traumatic life events that occur from birth till 18 years of age (Sideli et al., 2020). Adverse childhood experiences are associated with psychopathology in adulthood; stronger

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and consistent evidence has emerged on the associations between adverse childhood experiences and major depressive disorder, bipolar disorder, and schizophrenia spectrum disorders (Croft et al., 2018; McKay et al., 2020; Okkels et al., 2016). These disorders are commonly defined as severe mental disorders, which are prolonged and recurrent, cause significant distress and impairment, and require long-term treatment (Grubaugh et al., 2011; Zumstein and Riese, 2020).

Previous studies have identified transdiagnostic risk factors and their associations with childhood adversity-related severe mental disorders (Hoppen and Chalder, 2018; Sideli et al., 2020). Transdiagnostic risk factors are disrupted processes common to psychopathology and include, but are not limited to, emotion dysregulation, attachment anxiety, maladaptive personality traits, and lack of social support (Hoppen and Chalder, 2018). Further research has revealed mediating and moderating effects of transdiagnostic risk factors and these findings have important implications for assessment and treatment of childhood adversity-related severe mental disorders (Hoppen and Chalder, 2018; Sideli et al., 2020).

In contrast to transdiagnostic risk factors, transdiagnostic protective factors reduce the severity of psychopathology and are largely understudied in the child adversity–mental health literature (Lynch et al., 2021; Morgan and Gayer-Anderson, 2016; Radua et al., 2018). Transdiagnostic protective factors comprise both intrapersonal (e.g. emotion regulation) and interpersonal (e.g. social support) resources; however, few studies have included both types of resources in their models under investigation. Consequently, we do not have a good understanding on the interrelationships and interactions between intra- and interpersonal resources (Lynch et al., 2021). Moreover, there is a lack of research that has investigated the cultural relevancy of transdiagnostic protective factors and whether these factors can be understood within an overarching theory (Hoppen and Chalder, 2018; Lynch et al., 2021).

In view of the broad range of transdiagnostic protective factors in the literature, a positive mental health framework may guide the selection of culturally relevant intra- and interpersonal resources for further investigation. Mental health is broadly defined as an individual's capacity to realize his or her potential, cope with life's stressors, work productively, and contribute meaningfully to society; positive mental health relates to an individual's attitudes toward themselves and the environment, and their ability to react and adapt to situations (Jahoda, 1958; World Health Organization [WHO], 2005). Positive mental health and mental disorders are correlated but distinct constructs; positive mental health comprises both intra- and interpersonal resources, and the lack of these resources (e.g. inability to experience positive emotions and form close relationships) leads to poor mental health, which in turn increases the risk for mental disorders (Lynch et al., 2021; Westerhof and Keyes, 2010).

Given that intra- and interpersonal resources constituting positive mental health will vary across cultures, a Positive Mental Health Instrument was developed and validated in Singapore, a Southeast Asian country comprising 74.3% Chinese, 13.4% Malay, 9% Indians, and 3.3% other ethnic groups (Vaingankar et al., 2011). Within this multi-ethnic cultural context, the positive mental health framework included these six intra- and interpersonal resources: general affect, general coping, interpersonal skills, emotional support, spirituality, and personal growth and autonomy (Vaingankar et al., 2011). General affect and general coping relate to an individual's affective state (i.e. feelings of calm, happiness, peace, relaxation, and enthusiasm) and general coping strategies (e.g. distraction and cognitive reappraisal), respectively. Interpersonal skills refer to an individual's ability and willingness to relate to others, while emotional support refers to perceived support from an individual's social network. Spirituality relates to an individual's spiritual beliefs in a higher power. Personal growth and autonomy relate to an individual's beliefs in the malleability of human traits and attributes in the face of challenges and adversities. Overall, these positive mental health resources are transdiagnostic protective factors which are conceptualized under an overarching theory.

Preliminary research revealed lower levels of emotional support, interpersonal skills, and personal growth and autonomy among outpatients with severe mental disorders than the general population (Sambasivam et al., 2016). However, previous studies were based on small clinical samples, and more research is required to determine the interactions among these resources and their associations with childhood adversity-related severe mental disorders at the population level. To address aforementioned gaps in the literature, the present population-based study determined the association between a positive mental health framework of transdiagnostic protective factors and severe mental disorders (i.e. major depressive disorder, bipolar disorder, and schizophrenia spectrum disorders) in individuals with adverse childhood experiences. We hypothesized that (1) individuals with adverse childhood experiences will experience more severe mental disorders and poorer intra- and interpersonal resources than those without adverse childhood experiences; (2) intrapersonal (e.g. general coping) and interpersonal resources (e.g. emotional support) will interact to predict severe mental disorders.

Methods

Participants and procedure

The present study was part of the Singapore Mental Health Study (SMHS) 2016, which was a nationwide, cross-sectional epidemiological study conducted between August 2016 and April 2018 to establish the prevalence of mental disorders in Singapore (Subramaniam et al., 2020b).

Singapore citizens and permanent residents who were above 18 years of age, residing within the country during the study period, and able to speak and comprehend English, Chinese, or Malay were invited to participate in the SMHS 2016. Face-to-face interviews were conducted by trained interviewers during home visits to eligible participants. The Positive Mental Health Instrument was only available in English, and participants returned the self-administered questionnaire through mail. A total of 4441 and 2270 participants completed the adverse childhood experiences and the positive mental health measures, respectively; a total of 1929 participants completed both measures and were included in the present study. The SMHS 2016 was approved by the National Healthcare Group's Domain Specific Review Board; written informed consent was obtained from all participants, and parental consent was sought from participants below 21 years old.

Measurement instruments

Socio-demographic information. The following socio-demographic information was obtained: age, gender, ethnicity, marital status, education, employment, and monthly household income.

Adverse childhood experiences. The Adverse Childhood Experiences—International Questionnaire was used to assess for physical, emotional, and sexual abuse; physical and emotional neglect; household dysfunction (e.g. living with family members who were suffering from mental illnesses); and exposure to collective and peer violence in the first 18 years of life (WHO, 2018). Participants' responses were coded as a binary (yes/no) variable for each adverse childhood experience, and the prevalence rates were reported in another study (Subramaniam et al., 2020a). The present study used an overall binary variable to identify those who had endorsed at least one adverse childhood experience.

Severe mental disorders. Severe mental disorders were defined as major depressive disorder, bipolar disorder, and schizophrenia spectrum disorders in the present study (Grubaugh et al., 2011; Zumstein and Riese, 2020). Participants were first screened for psychiatric symptoms on the World Health Organization—Composite International Diagnostic Interview Version 3.0 (WHO-CIDI 3.0) by trained interviewers. Participants who endorsed depressive or bipolar symptoms on the screener questionnaire were further assessed for lifetime and 12-month major depressive disorder or bipolar disorder on the WHO-CIDI 3.0. The WHO-CIDI 3.0 is a structured interview which utilizes the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* diagnostic algorithm and has good convergent validity with the Structured Clinical Interview (SCID-1) (Kessler and Ustun, 2004). Participants who endorsed positive psychotic symptoms on the

screener questionnaire were further assessed for lifetime schizophrenia and other psychotic disorders (i.e. brief psychotic disorder, schizophreniform disorder, schizoaffective disorder, delusional disorder, substance-induced psychotic disorder, and psychotic disorder not otherwise specified) on the SCID-1 by experienced clinicians (Subramaniam et al., 2021). Accordingly, participants who were diagnosed with any of these mood and schizophrenia spectrum disorders were categorized into the severe mental disorders group; a binary (yes/no) outcome variable was formulated for severe mental disorders.

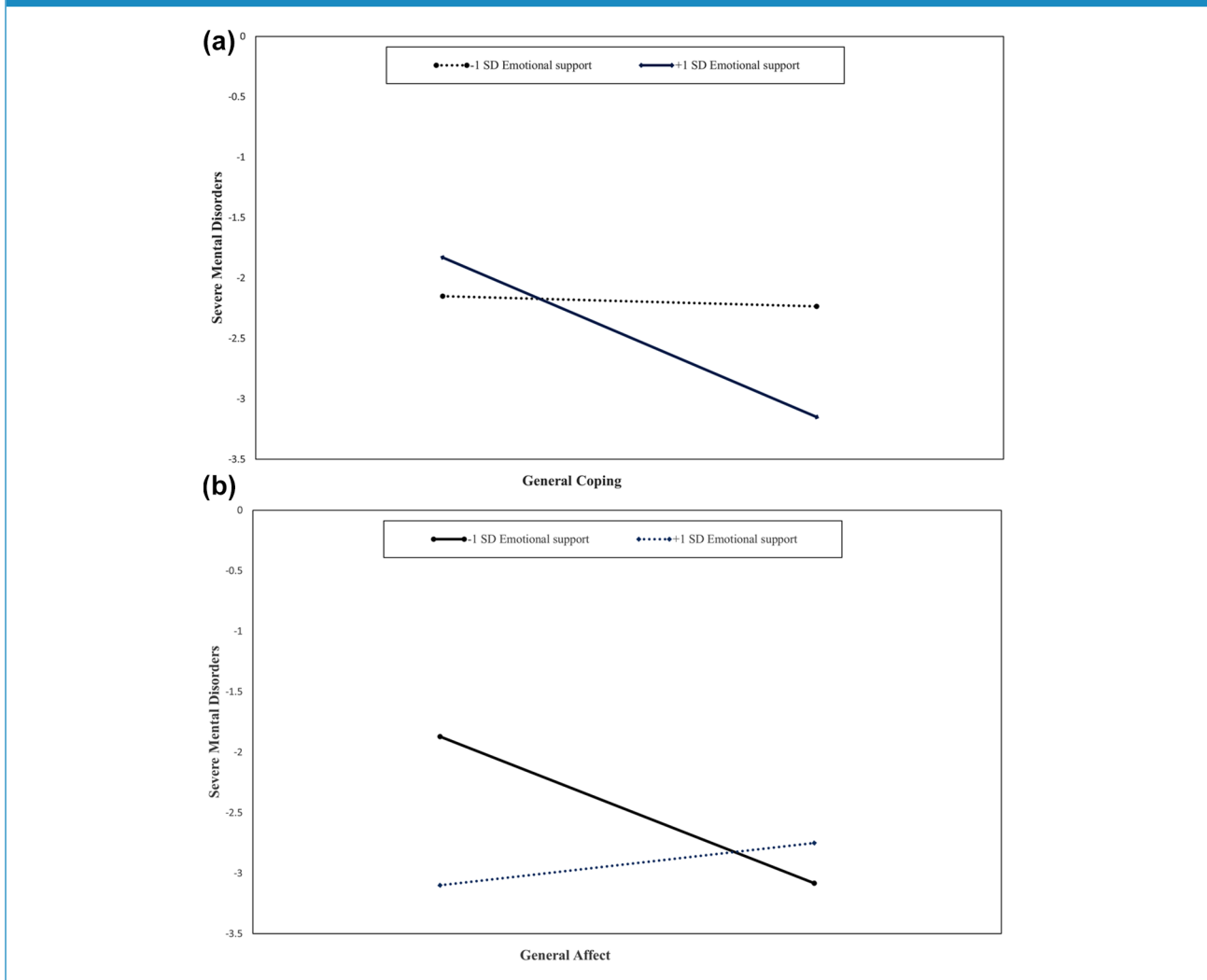
Positive mental health. The Positive Mental Health Instrument was used to assess for positive mental health (Vainankar et al., 2011). This 47-item self-report measures six intra- and interpersonal resources: general coping, emotional support, spirituality, interpersonal skills, global affect, personal growth and autonomy. The global affect subscale required participants to rate how often over the past 4 weeks they felt calm, happy, peaceful, relaxed, and enthusiastic on a 5-point Likert-type scale ranging from 1 (*never or very rarely*) to 5 (*very often or always*). The remaining subscales required participants to rate how much each item applied to them on a 6-point Likert-type scale ranging from 1 (*not at all like me*) to 6 (*exactly like me*). Higher scores for each subscale indicate positive levels of each resource. There were good internal consistencies of intra- and interpersonal resources in the present study; general coping ($\alpha=0.91$); emotional support ($\alpha=0.89$); spirituality ($\alpha=0.96$); interpersonal skills ($\alpha=0.89$); global affect ($\alpha=0.91$); personal growth and autonomy ($\alpha=0.93$). Confirmatory factor analysis for the six-factor model revealed adequate fit (root mean square error of approximation=0.04, $p > 0.05$; comparative fit index=0.94) and factor determinacies range from 0.95 to 0.98.

Statistical analyses

All statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 24.0, with alpha set at 0.05 for all procedures. Preliminary analyses included correlational tests, independent *t*-tests, and chi-square tests (1) to determine sample differences between the present study's participants ($n=1929$) and those who were excluded ($n=2512$); (2) to determine whether participants with adverse childhood experiences ($n=1208$) had more severe mental disorders and poorer intra- and interpersonal resources those without adverse childhood experiences ($n=721$); and (3) to determine the univariate associations between intra- and interpersonal resources and adverse childhood experiences, and severe mental disorders.

Moderation analysis based on probit regression was performed using the PROCESS 3.3 tool (Hayes, 2018). Each intra- and interpersonal resource was mean-centered and multiplied together to form individual interaction terms. All

Figure 1. (A) Interaction plot of general coping and emotional support on severe mental disorders for those with adverse childhood experiences. (B) Interaction plot of general affect and emotional support on severe mental disorders for those with adverse childhood experiences.



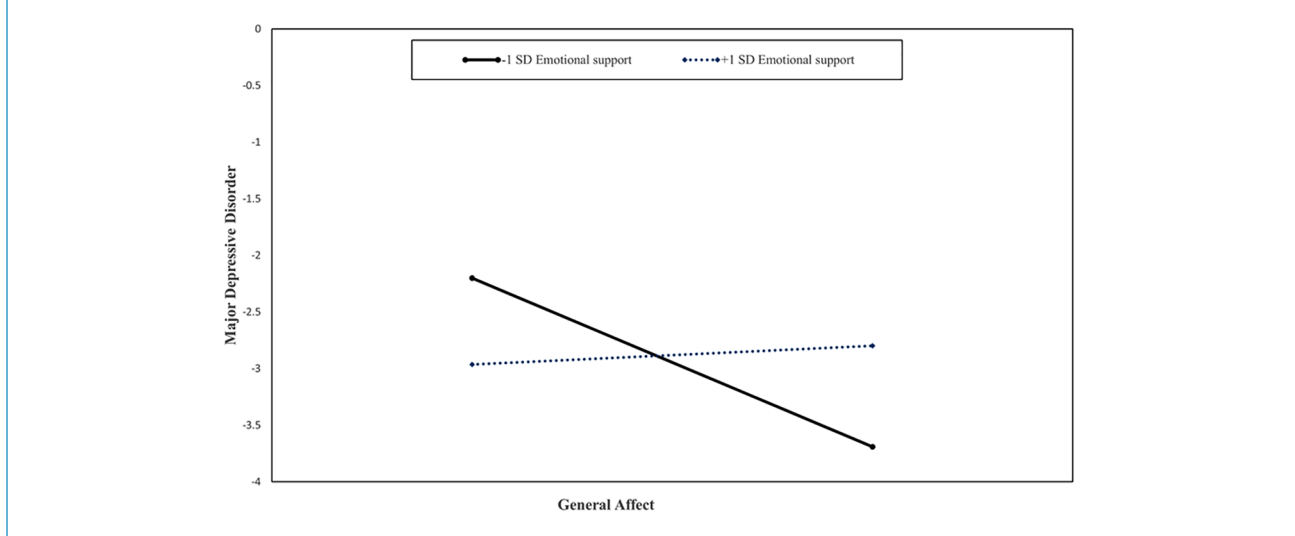
resource variables were tested for multicollinearity, and the results revealed acceptable tolerance and variance inflation factor values. Hence, a multivariate approach was adopted where all interaction terms, individual resource variables, and covariates (i.e. age and gender) were included in a single multivariate model with severe mental disorders as the dependent variable. Significant interactions were probed using the pick-a-point approach ± 1 standard deviation (SD) and Johnson-Neyman procedures through the PROCESS 3.3 tool (Hayes, 2018).

Overall, our main moderation analyses include (1) those exposed to adverse childhood experiences ($n=1208$) on severe mental disorders; (2) those exposed to adverse childhood experiences ($n=1208$) on individual diagnoses of major depressive disorder,

bipolar disorder, and schizophrenia spectrum disorders; and (3) subgroups of those exposed to physical abuse/neglect only ($n=98$) or emotional abuse/neglect only ($n=857$) or dysfunctional households only ($n=309$) on severe mental disorders.

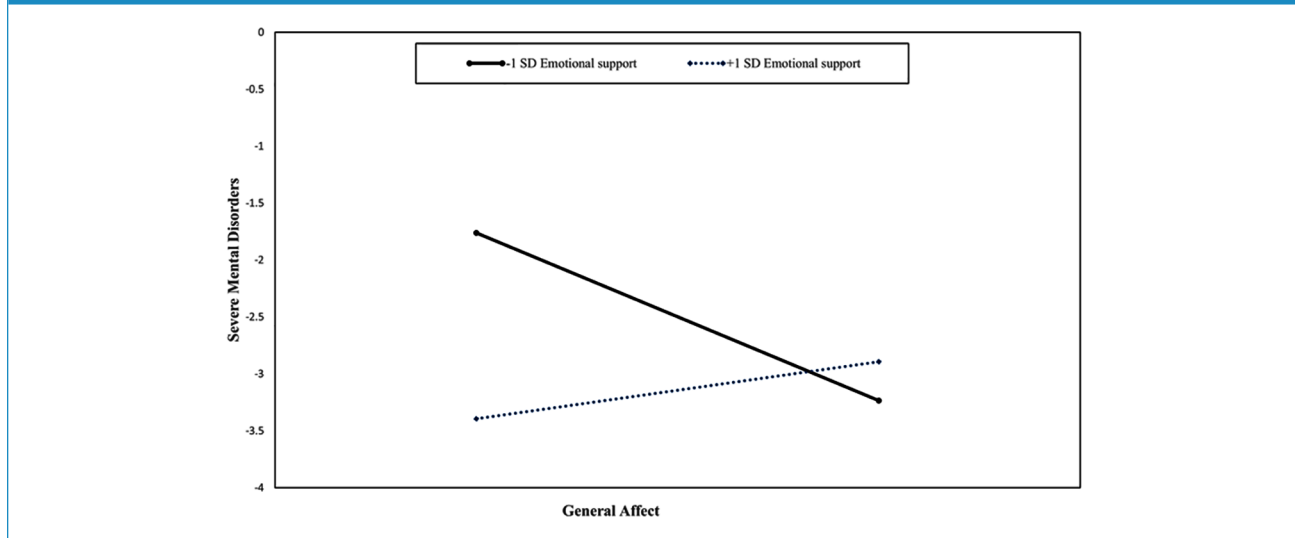
Our supplementary moderation analyses include (1) whole sample ($n=1929$) on severe mental disorders; (2) those exposed to adverse childhood experiences ($n=1208$) on individual diagnoses of alcohol use disorder, generalized anxiety disorder, and obsessive-compulsive disorder; and (3) the interaction between a continuous measure of overall number of adverse childhood experiences and positive mental health resources on severe mental disorders (see Supplementary Moderation Analyses; Figure S1, Figure S2, and Figure S3).

Figure 2. Interaction plot of general affect and emotional support on major depressive disorder for those with adverse childhood experiences.



Bold lines represent significant effects. Major depressive disorder is expressed in a log-odds metric.

Figure 3. Interaction plot of general affect and emotional support on severe mental disorders for those with emotional abuse/neglect.



Bold lines represent significant effects. Severe mental disorders are expressed in a log-odds metric.

Results

Sample characteristics

Table 1 presents the socio-demographic information for the present sample ($N=1929$). In brief, the mean age of the sample was 44.3 years, and there were slightly more females (51.5%) than males (48.5%). More than half of the sample (62.6%) were exposed to at least one adverse childhood experience, and 7.4% of the sample were diagnosed with severe mental disorders.

Preliminary analyses

Differences between included and excluded participants. Excluded participants were more likely to be males, had low monthly income (below S\$2000), and obtained primary, secondary or vocational education statuses. There were no significant group differences for adverse childhood experiences and severe mental disorders.

Differences between those with and without adverse childhood experiences. Adverse childhood experiences were

Table 1. Socio-demographics and clinical characteristics.

Variable (N = 1929)	N (%) / M ± SD
Age	44.3 ± 16.42
18–34	632 (32.8)
35–49	533 (27.6)
50–64	500 (25.9)
≥65	263 (13.6)
Gender	
Male	936 (48.5)
Female	992 (51.5)
Ethnicity	
Chinese	612 (31.7)
Malay	519 (26.9)
Indian	574 (29.8)
Others	223 (11.6)
Marital status	
Single	603 (31.3)
Married	1179 (61.2)
Divorced or separated	89 (4.6)
Widowed	57 (3.0)
Education	
Primary and below	93 (4.8)
Secondary	479 (24.8)
Junior college	135 (7.0)
Vocational	136 (7.1)
Diploma	425 (22.0)
University	660 (34.2)
Employment	
Employed	1370 (71.1)
Economically inactive	466 (24.2)
Unemployed	92 (4.8)
Monthly household income (in SGD)	
2000–3999	415 (21.5)
4000–5999	368 (19.1)
6000–9999	400 (20.7)
≥10,000	378 (19.6)
<2000	245 (12.7)
Severe mental disorders ^a	
Yes	143 (7.4)
No	1861 (96.5)

(Continued)

Table 1. (Continued)

Variable (N = 1929)	N (%) / M ± SD
Major depressive disorder	113 (5.9)
Bipolar disorder	29 (1.5)
Schizophrenia spectrum disorders	8 (0.4)
Alcohol use disorder	74 (3.8)
Generalized anxiety disorder	37 (1.9)
Obsessive-compulsive disorder	80 (4.1)
Adverse childhood experiences	
Physical abuse	102 (5.3)
Emotional abuse	146 (7.6)
Sexual abuse	60 (3.1)
Physical neglect	86 (4.5)
Emotional neglect	851 (44.1)
Bullying	41 (2.1)
Battered mother or female guardian	177 (9.2)
Parental separation, divorce, or death	441 (22.9)
Living in dysfunctional household (substance abusers)	97 (5.0)
Living in dysfunctional household (mental illness)	105 (5.4)
Living in dysfunctional household (imprisonment)	74 (3.8)

SD: standard deviation.

^aSevere mental disorders refer to major depressive disorder, bipolar disorder, and schizophrenia spectrum disorders.

significantly associated with more severe mental disorders, $\chi^2(1, N=1929)=38.29, p<0.001$; Cramer’s $V=.14$. Individuals with adverse childhood experiences had significantly lower mean scores for general coping, general affect, emotional support, interpersonal skills, and personal growth and autonomy than those without adverse childhood experiences ($ps<0.01$). There were no significant group differences for spirituality.

Associations between intra- and interpersonal resources and adverse childhood experiences, and severe mental disorders. Table 2 presents the associations between intra- and interpersonal resources and adverse childhood experiences, and severe mental disorders. General coping, general affect, emotional support, interpersonal skills, and personal growth and autonomy were significantly negatively correlated with adverse childhood experiences ($rs=-0.223$ to -0.133 ; $ps<0.001$) and severe mental disorders ($rs=-0.178$ to -0.087 ; $ps<0.001$). Spirituality was not significantly associated with adverse childhood experiences and severe mental disorders.

Table 2. Associations between intra- and interpersonal resources and adverse childhood experiences, and severe mental disorders.

	ACE	SMD	GC	GA	ES	IS	S	PGA
ACE	-							
SMD	.252*	-						
GC	-0.133*	-0.154*	-					
GA	-0.223**	-0.178**	0.522**	-				
ES	-0.201**	-0.138**	0.523**	0.509**	-			
IS	-0.140**	-0.087**	0.586**	0.536**	0.643**	-		
S	-0.027	-0.041	0.263**	0.228**	0.349**	0.336**	-	
PGA	-0.167**	-0.158**	0.571**	0.575**	0.592**	0.688**	0.289**	-

ACE: adverse childhood experiences (continuous measure); SMD: severe mental disorders; GC: general coping; GA: general affect; ES: emotional support; IS: interpersonal skills; S: spirituality; PGA: personal growth and autonomy.

* $p < 0.05$, ** $p < 0.01$.

Table 3. Interaction and main effects of each intra- and interpersonal resource on severe mental disorders for those with adverse childhood experiences.

	Severe mental disorders		
	OR	95% CI	p value
GC × ES	0.70*	[0.49, 0.99]	0.04
GA × ES	1.58*	[1.11, 2.26]	0.01
GC × GA	0.94	[0.66, 1.32]	0.73
GC × IS	1.03	[0.70, 1.54]	0.85
GC × PGA	1.08	[0.73, 1.59]	0.67
GA × IS	0.73	[0.44, 1.22]	0.23
GA × PGA	1.05	[0.68, 1.62]	0.81
ES × IS	0.93	[0.62, 1.40]	0.73
ES × PGA	1.13	[0.77, 1.66]	0.50
IS × PGA	0.77	[0.45, 1.29]	0.32
GC	0.65**	[0.50, 0.85]	0.002
GA	0.83	[0.60, 1.15]	0.26
ES	0.83	[0.58, 1.18]	0.30
IS	1.20	[0.73, 1.96]	0.45
PGA	0.94	[0.61, 1.45]	0.80

OR: odds ratio; CI: confidence interval; GC: general coping; GA: general affect; ES: emotional support; IS: interpersonal skills; PGA: personal growth and autonomy. Model was adjusted for age and gender.

* $p < 0.05$, ** $p < 0.01$.

Moderation analyses

Based on the significant univariate associations, we created and tested the interaction terms for general coping, general affect, emotional support, interpersonal skills, and personal growth and autonomy in age and gender adjusted multivariate moderation models for the (1) whole sample; and (2) separately between those with and without adverse childhood experiences. Our results were similar for the whole sample and subgroup analyses for those with adverse childhood experiences; thus, we have reported the subgroup analysis for greater specificity between those with and without adverse childhood experiences. The results for the whole sample analysis are reported in the supplementary material. Moderation analysis revealed two significant interactions in the subgroup with adverse childhood experiences: general coping × emotional support (odds ratio [OR]=0.70, 95% confidence interval [CI] [0.49, 0.99], $p=0.04$) and general affect × emotional support (OR=1.58, 95% CI [1.11, 2.26], $p=0.01$). Table 3 presents the interaction and main effects of each intra- and interpersonal resource on severe mental disorders for those with adverse childhood experiences. There were no significant interaction or main effects of intra- and interpersonal resources for those without adverse childhood experiences. Hence, interaction probing was only performed for the subgroup with adverse childhood experiences.

Further interaction probing of the significant interactions revealed that at high emotional support (+1 SD from mean; conditional effect OR=0.49, 95% CI [0.32, 0.73], $p=0.0005$), general coping was negatively associated with severe mental disorders. General coping was not associated with severe mental disorders at low emotional support (-1 SD from mean). Figure 1(A) shows the interaction plot of general coping and emotional support on severe mental

disorders for those with adverse childhood experiences. Interaction probing also revealed that at low emotional support (-1 SD from mean; conditional effect $OR=0.51$, 95% CI [0.31, 0.83], $p=0.0074$), general affect was negatively associated with severe mental disorders. General affect was not associated with severe mental disorders at high emotional support ($+1$ SD from mean). Figure 1(B) shows the interaction plot of general affect and emotional support on severe mental disorders for those with adverse childhood experiences.

To further examine the transdiagnostic effect of positive mental health resources across diagnostic profiles, we conducted our moderation analysis for each diagnosis as the primary outcome. Our results for major depressive disorder revealed a significant interaction between general affect \times emotional support ($OR=1.55$, 95% CI [1.05, 2.29], $p=0.026$) and a main effect of general coping ($OR=0.61$, 95% CI [0.46, 0.80], $p<0.001$). Further interaction probing of the significant interaction revealed that at low emotional support (-1 SD from mean; conditional effect $OR=0.43$, 95% CI [0.25, 0.73], $p=0.0018$), general affect was negatively associated with major depressive disorder. General affect was not associated with major depressive disorder at high emotional support ($+1$ SD from mean). Figure 2 shows the interaction plot of general affect and emotional support on major depressive disorder for those with adverse childhood experiences.

Our results for bipolar disorder revealed a significant interaction between general coping \times emotional support ($OR=0.41$, 95% CI [0.19, 0.87], $p=0.02$). However, further interaction probing of the significant interaction did not reveal any significant conditional effects. Our results for schizophrenia spectrum disorders revealed a significant interaction between general coping \times general affect ($OR=4.46$, 95% CI [1.39, 14.27], $p=0.012$) and a main effect of personal growth and autonomy ($OR=0.12$, 95% CI [0.02, 0.71], $p=0.019$). However, further interaction probing of the significant interaction did not reveal any significant conditional effects.

In addition to diagnostic profiles, we had also conducted our moderation analyses across subgroups of individuals exposed to physical abuse/neglect or emotional abuse/neglect or dysfunctional households. Our results for those exposed to emotional abuse/neglect only revealed a significant interaction between general affect \times emotional support ($OR=1.73$, 95% CI [1.14, 2.64], $p=0.01$) and a main effect of general coping ($OR=0.67$, 95% CI [0.48, 0.96], $p=0.028$). Further interaction probing of the significant interaction revealed that at low emotional support (-1 SD from mean; conditional effect $OR=0.44$, 95% CI [0.24, 0.80], $p=0.0081$), general affect was negatively associated with severe mental disorders. General affect was not associated with severe mental disorders at high emotional support ($+1$ SD from mean). Figure 3 shows the interaction plot of general affect and emotional support on severe

mental disorders for those with emotional abuse/neglect. There were no significant interactions or main effects for those exposed to physical abuse/neglect only.

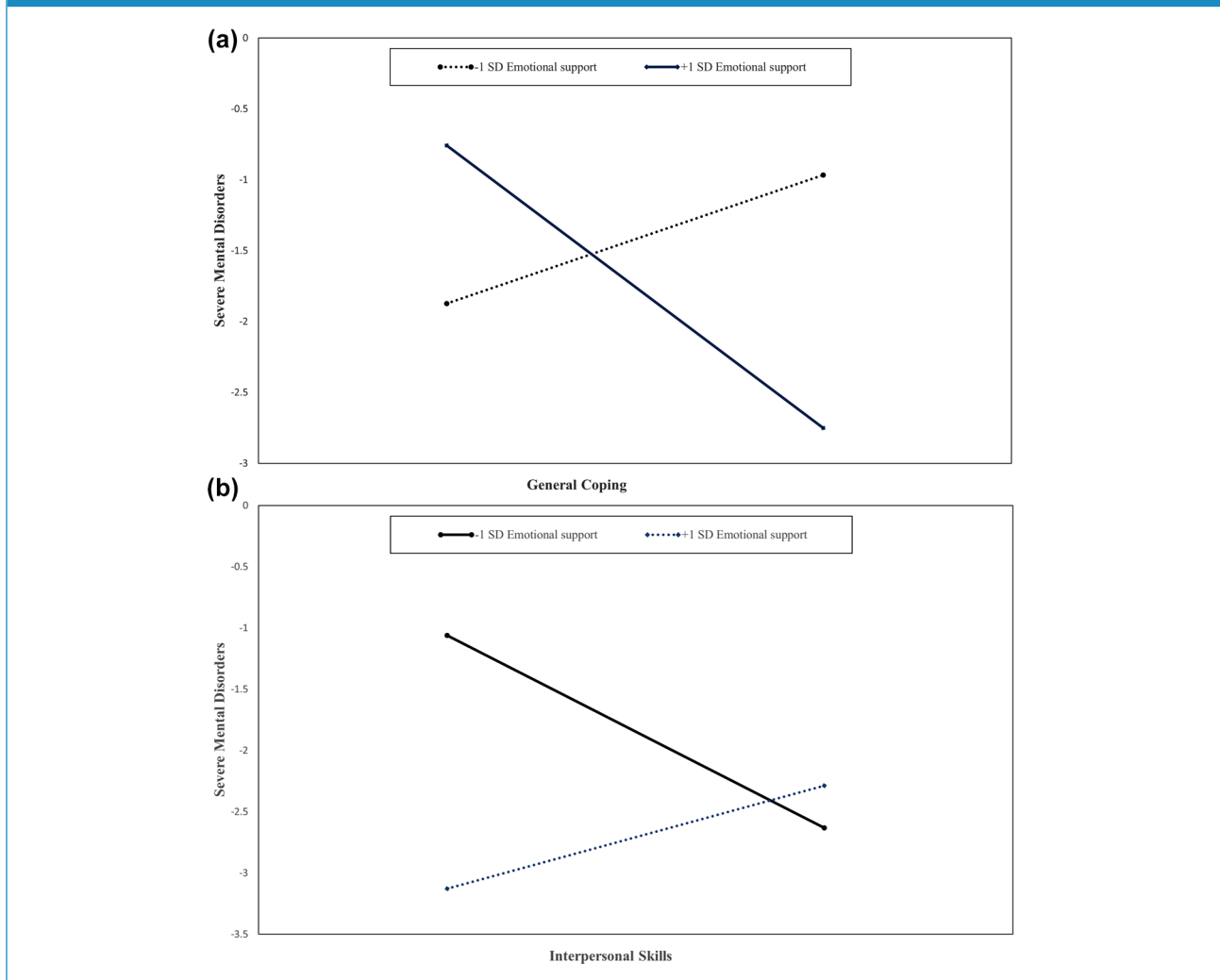
Our results for those living in dysfunctional households only revealed a significant interaction between general coping \times emotional support ($OR=0.43$, 95% CI [0.20, 0.92], $p=0.03$), and a significant interaction between interpersonal skills \times emotional support ($OR=2.46$, 95% CI [1.14, 5.32], $p=0.021$). Further interaction probing of the significant interaction (general coping \times emotional support) revealed that at high emotional support ($+1$ SD from mean; conditional effect $OR=0.34$, 95% CI [0.15, 0.76], $p=0.0088$), general coping was negatively associated with severe mental disorders. General coping was not associated with severe mental disorders at low emotional support (-1 SD from mean). Figure 4(A) shows the interaction plot of general coping and emotional support on severe mental disorders for those living in dysfunctional households. Further interaction probing of the significant interaction (interpersonal skills \times emotional support) revealed that at low emotional support (-1 SD from mean; conditional effect $OR=0.34$, 95% CI [0.12, 0.96], $p=0.0416$), interpersonal skills were negatively associated with severe mental disorders. Interpersonal skills were not associated with severe mental disorders at high emotional support ($+1$ SD from mean). Figure 4(B) shows the interaction plot of interpersonal skills and emotional support on severe mental disorders for those living in dysfunctional households.

Discussion

The present study was conducted to address current research gaps on the association between a positive mental health framework of transdiagnostic protective factors and childhood adversity-related severe mental disorders. We first found that individuals with adverse childhood experiences had more severe mental disorders and poorer intra- and interpersonal resources than those without adverse childhood experiences. Our finding on low protective resources in adulthood extends current understanding on the longstanding consequences of adverse childhood experiences; early adversity may not only directly increase the risk of later severe mental disorders, but also indirectly contribute to this risk by depleting protective resources. Consistently low protective resources in adulthood may also increase the risk of exposure to multiple traumas in adulthood, which in turn trigger the onset of severe mental disorders (Grubaugh et al., 2011). Thus, the mediating roles of low protective resources and adulthood trauma warrant further longitudinal investigation.

We next found that intra- and interpersonal resources were generally negatively associated with both adverse childhood experiences and severe mental disorders. Our results highlight that the toxic effects of adverse childhood experiences may be mitigated or ameliorated by malleable protective intra- and interpersonal resources. Trauma-focused

Figure 4. (A) Interaction plot of general coping and emotional support on severe mental disorders for those living in dysfunctional households. (B) Interaction plot of interpersonal skills and emotional support on severe mental disorders for those living in dysfunctional households.



interventions are informed by theory where early trauma shatters perceptions of the self (e.g. incompetent self), others (e.g. malicious intentions to harm individual), and the world (e.g. dangerous living environment) (Bryant, 2021; Schuler and Boals, 2016). While trauma-focused interventions target these negative cognitions to break the vicious cycle of traumatic memories and avoidance, they do not directly address mental health outcomes (Bryant, 2021). Accordingly, adjunctive positive mental health interventions are recommended to help reconstruct and heal an individual's socio-emotional world that was shattered by trauma.

Our most significant finding was the interaction between adverse childhood experiences and protective resources. Among those with adverse childhood experiences, emotional support interacted with general coping and general affect to predict severe mental disorders; general coping

and general affect were negatively associated with severe mental disorders at high (+1 SD) and low (-1 SD) emotional support, respectively. This finding addresses important research gaps on (1) the limitations of social support interventions; (2) which protective resources to address in the context of varying levels of social support; and (3) *when* and *among whom* should positive mental health interventions be implemented.

Recent meta-analytic research found a strong negative association between social support and post-traumatic stress disorder (PTSD); social support is an established protective interpersonal resource against traumatic stress (Wang et al., 2021). This evidence supports a plethora of social support interventions in the literature (e.g. positive parenting, family therapy, and wraparound interventions) (Bethell et al., 2019; Schneider-Munoz et al., 2015). However, a blanket approach to social support interventions may not be helpful for

individuals living in dysfunctional homes (e.g. loss of parental figures) and emotionally unsupportive environments. Moreover, growing evidence suggests that social support does not solely influence psychopathology. This view is supported by past research which found interactions between adverse childhood experiences and social support to predict depression and suicidality (Bethell et al., 2019; Logan-Greene et al., 2017), as well as interactions between social support and emotion regulation to predict depression (Marroquín, 2011).

Although these studies paved the way for further investigation on the interactions between adverse childhood experiences and intra- and interpersonal resources on clinical outcomes, none have adopted a holistic and culturally relevant framework to investigate the interactions between transdiagnostic protective resources and childhood adversity-related severe mental disorders. Hence, our interaction findings contribute to the extant literature by (1) identifying two intrapersonal resources (i.e. general coping and general affect) as points of intervention for individuals with adverse childhood experiences; and that (2) these interventions should be tailored according to the level of emotional support. In accordance with our interaction results, positive mental health interventions should prioritize general coping strategies and support self-efficacy when emotional support is assessed to be high, while the focus should be on improving and maintaining positive affect when emotional support is assessed to be low. Overall, our results identified individuals with adverse child experiences and low emotional support as one vulnerable group to benefit most from these interventions.

In addition to investigating the interaction and main effects of positive mental health resources in those with adverse childhood experiences in general, the present study examined whether similar effects were observed in (1) subgroups of adverse childhood experiences (i.e. physical abuse/neglect or emotional abuse/neglect or dysfunctional households only); (2) overall number of adverse childhood experiences experienced (i.e. cumulative exposure); and (3) subgroups of mental disorder diagnostic profiles. First, we found similar interaction and main effects of positive mental health resources in those exposed to emotional abuse/neglect or dysfunctional households only. These two types of adverse childhood experiences are characterized by a higher severity of emotional maltreatment, poor attachment relationships, and lack of social support (Carr et al., 2013; Humphreys et al., 2020). Hence, intra-personal resources and emotional support were observed to interact in these subgroups. Overall, increased positive mental health resources may be more likely to mitigate the deleterious effects of these two types of adverse childhood experiences; however, further longitudinal work is required. In contrast to the emotional abuse/neglect subgroup, we did not observe any significant interaction or main effects of positive mental health resources in the physical abuse/neglect subgroup. Our results are aligned

with previous works where emotional adversities have a stronger effect on psychopathology (Carr et al., 2013; Grummitt et al., 2021; Humphreys et al., 2020).

Second, we did not observe a significant interaction between an overall number of adverse childhood experiences experienced and positive mental health resources. Our preliminary results suggest that cumulative adverse childhood experiences do not exert a dose-response effect on positive mental health resources; however, further longitudinal work is required. Finally, we found similar interaction and main effects of positive mental health resources across diagnostic profiles of major depressive disorder, bipolar disorder, schizophrenia spectrum disorders, and alcohol use disorder; there were no significant interaction or main effects for generalized anxiety disorder and obsessive-compulsive disorder. Within the severe mental disorders group, our results did not suggest that a single diagnosis was driving the reported effects and there is preliminary evidence on the transdiagnostic effects of positive mental health resources. While there were no significant conditional effects for bipolar disorder and schizophrenia spectrum disorders, this could be due to the small subgroup sizes. Hence, further longitudinal research with sufficient sample size for each diagnostic profile is required to elucidate the transdiagnostic effects of positive mental health resources on severe mental disorders over time.

Limitations and future research

The present study adopted a cross-sectional design and causality cannot be established among the study variables. We were not able to determine the temporal relationships between adverse childhood experiences and severe mental disorders. It is possible that reverse causation could have occurred where the early onset of severe mental disorders led to adverse childhood experiences. Hence, a longitudinal investigation is required to clarify the temporal and causal relationships of the present study variables.

The present study retrospectively assessed for adverse childhood experiences, and our findings on adverse childhood experiences may be under- or overreported due to the influence of memory bias. However, research evidence demonstrates that patients with severe mental disorders can accurately self-report on adverse childhood experiences and that retrospective assessments are both valid and reliable (Gibson et al., 2016; Grubaugh et al., 2011). The present study may have also introduced systematic bias by excluding participants who did not complete the positive mental health measure; however, we had performed supplementary analyses by adjusting for gender, income, and education statuses, and the results remained consistent with our main findings.

The present study did not assess for adulthood trauma. Interpersonal violence and sexual assault in adulthood are significantly associated with severe mental disorders (Grubaugh et al., 2011). Furthermore, positive psychotic symptoms and hospitalization are traumatic experiences

(Berry et al., 2013). Thus, future studies should consider a holistic assessment of adverse lifetime experiences and determine their cumulative impact on the risk for severe mental disorders. Finally, the present study did not assess for PTSD. Both PTSD and PTSD symptoms contribute to the onset and maintenance of mood disorders and schizophrenia spectrum disorders (Okkels et al., 2016; Strelchuk et al., 2020). Accordingly, future studies should determine the transdiagnostic pathways among intra- and interpersonal resources, adverse childhood experiences, PTSD, and severe mental disorders. In sum, our findings show that intra- and interpersonal protective resources interact, and determining at-risk individuals based on these interacting profiles is essential for optimal treatment of adverse childhood experiences and severe mental disorders.



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Data Availability Statement

The data are available from the corresponding author upon reasonable request and subjected to approval from our institutional ethical board.

Supplemental Material

Supplemental material for this article is available online.

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